

MARINE SAFETY MANUAL

- 3.F.3 a. (cont'd) first published December 12, 1968. Prior to that date, only automatic steam boilers operating at pressures exceeding 30 psi, used for purposes other than propulsion, were covered by regulations under 46 CFR 162.026 (Requirements for Boilers, Auxiliary, Automatically Controlled, Packaged, for Merchant Vessels). In actual practice, portions of Subpart 162.026 had been applied to other heating equipment. Certain portions of 162.026 were used in Part 63; however, the preponderance of Part 63 requirements were new at that time.
- b. Incinerators. Incinerators installed on U.S. Coast Guard certificated and inspected vessels must comply with Title 46 of the Code of Federal Regulations (46 CFR) Subpart 63.25-9. 46 CFR 63.25-9 requires that incinerators meet the standards in International Maritime Organization Resolution MEPC.76(40), be tested for its emissions at an independent laboratory acceptable to the U.S. Coast Guard, and also be type approved by the U.S. Coast Guard. Type approvals are conducted by the Marine Safety Center.

G. Electrical Systems.

1. Introduction.

- a. Overview of Electrical Systems. Electrical regulations are provided to set forth uniform minimum requirements for electrical equipment and systems aboard vessels in accordance with the intent of various statutes, the International Convention for Safety of Life at Sea (SOLAS), and other treaties that contain requirements regarding electrical installations. These requirements are intended to ensure that electrical installations aboard vessels provide services necessary for safety under both normal and emergency conditions and protect passengers, crewmembers, and other persons from electrical hazards. In addition, environmental concerns have played a major role in the development of various sections of the Electrical Engineering Regulations. Navigation and Vessel Inspection Circulars (NVIC's) and the Marine Safety Manuals (MSM), Volumes I-X, COMDTINST M16000 (series), augment regulations with clarifications and explanations.
- b. Purpose of MSM Guidance. The Electrical Engineering Regulations, 46 CFR Subchapter J, can be difficult to understand. Regulatory intent, equivalency information, inspections aids, and examples are not provided. This section of the MSM provides information to fill the void caused by the limitations of the regulations as they apply to electrical equipment and systems on merchant vessels and mobile offshore drilling units. It also promulgates information on equipment, systems, materials and methods that have been deemed by the Commandant (G-MSE) to provide an equivalent level of safety.

This guide's purpose is not to repeat the regulations, but to augment them. Nothing contained in this guide shall be taken as amending the Code of Federal Regulations, nor as limiting the authority of the Officer in Charge, Marine Inspection (OCMI) in the determination of acceptable materials, systems, and installation methods.

- c. History. Since the first electrical installations on the passenger ships "CITY OF BERLIN" and "MENDOZA" in 1879, a complex set of standards and regulations has evolved to address the hazards presented and the benefits provided by electrical equipment and

MARINE SAFETY MANUAL

- 3.G.1 c. (cont'd) systems. Domestically, early efforts involved the early Bureau of Marine Inspection and Navigation (predecessor to the Coast Guard's Marine Inspection Program) and the American Institute of Electrical Engineers (predecessor to the Institute of Electrical and Electronics Engineers). Internationally, these involved the individual classification societies, the Intergovernmental Maritime Consultative Organization (predecessor to the International Maritime Organization) and the International Electrotechnical Commission. In the last few decades, the number of standards-making bodies affecting the marine electrical community has increased significantly.
- d. The Electrical Program. The Marine Inspection Program uses plan review, and on-site inspection to ensure that electrical installations are designed, built and maintained in a manner to promote the safety of the vessel, its crew and passengers. The Electrical Engineering Regulations provide uniform minimum requirements for electrical equipment and systems in accordance with the intent of various statutes, the International Convention for Safety of Life at Sea (SOLAS), and other treaties that contain requirements regarding electrical installations. These requirements are intended to ensure electrical installations aboard vessels provide services necessary to protect passengers, crewmembers and other persons from electrical hazards.
- e. Electrical Safety. Electrical Safety on ships includes the prevention of shock, fire and panic.

On a steel hulled vessel, a person is usually walking on or touching ground at all times, and is usually within reach of power cables or electrical equipment containing lethal voltages. The currents that can flow from an energized conductor to ground can be very large, even in an ungrounded system. Currents as low as twenty-five thousandths of an ampere (25 milliamps) that pass through the heart can cause death. Currents of a non-fatal magnitude, or currents having a path to ground through other parts of the body can cause severe burns and injury. Minor shocks can also create severe secondary injuries when muscles contract involuntarily.

Fire is the greatest dread of seamen, and electricity is one of the most frequent causes of fire. A fire hazard can exist wherever electrical potential is present, and on a ship, the electrical installation covers a far greater area than any other type of installation.

How can electricity start a fire? Current flowing through a conductor encounters resistance. This resistance generates heat. If the conductor is properly sized, the heat is harmlessly dissipated. Where the conductor is not adequately sized for the current, or where the heat generated by the current is prevented from properly dissipating, whether it is the normal current, an overload current, or a fault (high or low impedance) current, the heat can become excessive, and can start a fire in nearby combustible materials, such as cable insulation.

Electrically-caused fires most often involve wire and cable. Most vessels have many miles of cable run throughout the entire vessel spreading their risks to all locations. Whenever the protective

MARINE SAFETY MANUAL

- 3.G.1 e. (cont'd) insulation of a wire or cable is damaged by heat, moisture, oils, corrosive materials, vibration, abrasion, or impact, or where faulty installation or operating conditions result in loose connections, the threat of fire exists.

Motors are also a frequent source of electrically-caused fires. Motor fires can be caused by overheating, such as would be caused by overloading, single phasing, inadequate ventilation, malfunctions, such as internal faults and arcing, and bearing failure caused by inadequate lubrication.

Proper shipboard electrical installations also help reduce or prevent panic during an emergency. Put an individual, such as a vessel passenger, in the dark, in a strange place, in threatening circumstances, and the stage is set for panic. Electrical installations are designed to keep the lights on, power vital equipment, and allow needed information to be passed to passengers and crew.

- f. Regulations and References. The Electrical Engineering Regulations, 46 CFR Parts 110 - 113 (Subchapter J), contain the primary standards for the review of electrical installation on USCG certificated vessels. See Table 3G-1 for vessel types and their primary/secondary applicable subchapter of the 46 CFR regulations.

Table 3G-1
Applicable Electrical Regulations

Vessel Type	Primary / Secondary Subchapter
MODU	I-A / J
Offshore Supply Vessels	L
Small Passenger Vessels > 150 passengers or with overnight accommodations >49 people.	K
Small Passenger Vessels Under 100 Gross Tons < 150 passengers or with overnight accommodations <49 people, > 6 passengers.	T
Passenger Vessels (100 GT or more)	H / J
Tank Vessels	D / J
Uninspected Vessels	C
Cargo & Miscellaneous Vessels	I / J

- g. Maintenance of Standards. 46 CFR 110.10-1(b) lists the industry specifications, standards, and codes that are incorporated by reference and supplement the Electrical Engineering Regulations. For the most part, these standards are dynamic. Therefore, references and associated amendments are listed with publication dates to inform